

1 CLAIMS

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3 We claim:

1 1. A method for communicating with at least one subscriber,
2 the method comprising:
3 transmitting orthogonal frequency domain multiplexing (OFDM)
4 signals to the at least one subscriber; and
5 receiving direct-sequence spread spectrum (DSSS) signals from
6 the at least one subscriber.

1 2. The method defined in Claim 1 wherein receiving the DSSS
2 signals comprises receiving multiple code division multiple access
3 (CDMA) signals from a plurality of subscribers.

1 3. A method for communicating with a base station, the
2 method comprising:
3 receiving orthogonal frequency domain multiplexing (OFDM)
4 signals from the base station; and
5 transmitting direct-sequence spread spectrum (DSSS) signals to
6 the base station.

1 4. The method defined in Claim 3 wherein transmitting the
2 DSSS signals comprises transmitting multiple code division multiple
3 access (CDMA) signals from a plurality of subscribers.

1 5. A system comprising:
2 a subscriber having
3 a DSSS transmitter,
4 an OFDM receiver,
5 a first antenna coupled to the DSSS transmitter and the
6 OFDM receiver;
7 a base station communicably coupled with the subscriber, the
8 base station having
9 a DSSS receiver,
10 an OFDM transmitter,
11 a second antenna coupled to the DSSS receiver and the
12 OFDM transmitter.

1 6. The system defined in Claim 5 further comprising:

2 a first switch to couple to the DSSS transmitter and the OFDM
3 receiver to the first antenna; and
4 a second switch to couple to the DSSS receiver and the OFDM
5 transmitter to the second antenna.

1 7. The system defined in Claim 5 further comprising:
2 a first frequency duplexer to couple to the DSSS transmitter and the
3 OFDM receiver to the first antenna; and
4 a second frequency duplexer to couple to the DSSS receiver and the
5 OFDM transmitter to the second antenna.

1 8. The system defined in Claim 5 wherein the OFDM
2 transmitter comprises:
3 a plurality of processing paths, wherein each of the processing
4 paths has
5 a forward error correction (FEC) encoder,
6 an interleaver coupled to an output of the FEC encoder,
7 and
8 a modulator coupled to an output of the interleaver; and

9 an inverse Fast Fourier Transform (IFFT) coupled to receive
10 outputs from modulators in the plurality of processing paths and to
11 output OFDM signals.

1 9. The system defined in Claim 5 wherein the OFDM receiver
2 comprises:

3 a Fast Fourier Transform (FFT) unit to perform an FFT on OFDM
4 signals received from the base station;

5 a plurality of processing paths coupled to individual outputs of
6 the FFT unit, each of the plurality of processing paths having

7 a demodulator coupled to the one of the individual
8 outputs of the FFT unit,

9 a deinterleaver coupled to an output of the demodulator,
10 and

11 a forward error correction (FEC) decoder coupled to an
12 output of the deinterleaver, the output of the FEC decoder being user
13 data.

1 10. The system defined in Claim 5 wherein the DSSS
2 transmitter and the DSSS receiver comprise a CDMA transmitter and a
3 CDMA receiver, respectively.

1 11. The system defined in Claim 5 wherein the DSSS
2 transmitter comprises:
3 a forward error correction (FEC) encoder coupled to receive user
4 data;
5 an interleaver coupled to an output of the FEC encoder;
6 a modulator coupled to an output of the interleaver; and
7 a spreader coupled to an output of the modulator.

1 12. The system defined in Claim 5 wherein the DSSS receiver
2 comprises:
3 a plurality of processing paths, each of the processing paths
4 having
5 a correlator,
6 a channel estimator coupled to an output of the correlator, the
7 channel estimator having first and second outputs,

8 a Rake receiver coupled to an output of the correlator and
9 a first output of the channel estimator,
10 a de-interleaver coupled to an output of the Rake receiver,
11 a FEC decoder coupled to an output of the de-interleaver,
12 a FFT unit coupled to a second output of channel
13 estimator.

1 13. The system defined in Claim 12 wherein the DSSS receiver
2 further comprises a downlink OFDM subcarrier allocator coupled to
3 outputs of FFT units of the plurality of processing paths.

1 14. The system defined in Claim 5 wherein the base station further
2 comprises a DSSS transmitter and the subscriber comprises a DSSS receiver.

1 15. The system defined in Claim 14 wherein the DSSS
2 transmitter comprises a CDMA transmitter and the DSSS receiver
3 comprises a CDMA receiver.

1 16. The system defined in Claim 5 wherein the base station
2 further comprises:
3 a beacon generator to generate a beacon signal; and
4 a switch coupled to the beacon generator to combine the beacon
5 signal with OFDM symbols to create a transmission signal for output
6 from the base station.

1 17. The system defined in Claim 16 wherein the beacon signal
2 comprises at least one spread-spectrum pseudo-noise (PN) sequence.

1 18. The system defined in Claim 16 wherein the beacon signal
2 comprises a plurality of spread-spectrum pseudo-noise (PN) sequences.

1 19. The system defined in Claim 18 wherein the subscriber
2 uses a first portion of the plurality of spread-spectrum pseudo-noise
3 (PN) sequences for time synchronization.

1 20. The system defined in Claim 19 wherein the first portion
2 of PN sequence comprises one PN sequence.

1 21. The system defined in Claim 19 wherein the subscriber uses a
2 second portion of PN sequences following the first portion of PN sequences
3 for frequency tracking.

1 22. The system defined in Claim 21 wherein PN sequences in
2 the second portion of PN sequences are shorter than any PN sequences
3 in the first portion of PN sequences.

1 23. The system defined in Claim 5 wherein the CDMA
2 transmitter is for uplink communications.

1 24. The system defined in Claim 23 wherein the OFDM transmitter
2 transmits full bandwidth pilot OFDM symbols during downlink for open
3 loop power control.

1 25. A communication network comprising:
2 first and second systems, each of the first and second systems
3 including
4 a DSSS transmitter,

5 a DSSS receiver, and
6 an antenna coupled to the DSSS transmitter and DSSS receiver,
7 and further wherein the first system comprises an OFDM transmitter
8 coupled to its antenna and the second system comprises an OFDM
9 receiver coupled to its antenna.

1 26. The communication network defined in Claim 25 wherein
2 the DSSS transmitter and the DSSS receiver comprise a CDMA
3 transmitter and a CDMA receiver, respectively.

1 27. The communication network defined in Claim 25 wherein
2 the DSSS transmitter and DSSS receiver in each of the first and second
3 systems are implemented together as a CDMA transceiver and the
4 OFDM transmitter and the OFDM receiver are each included in separate
5 OFDM transceivers.

1 28. The communication network defined in Claim 25 wherein
2 the OFDM transmitter is for use with downlink transmissions.

1 29. The communication network defined in Claim 25 wherein
2 the OFDM transmitter and the CDMA transmitter in the second system
3 transmit separate downlink transmissions using downlink multiplexing.

1 30. The communication network defined in Claim 25 wherein
2 the downlink multiplexing comprises time division duplexing.

1 31. The communication network defined in Claim 25 wherein
2 the downlink multiplexing comprises frequency division duplexing.

1 32. The communication network defined in Claim 25 wherein
2 the first system comprises a switch coupling the DSSS transmitter, DSSS
3 receiver and the OFDM transmitter to the antenna.

1 33. The communication network defined in Claim 25 wherein the
2 first system comprises a duplexer coupling the DSSS transmitter, DSSS
3 receiver and the OFDM transmitter to the antenna.

1 34. The communication network defined in Claim 25 wherein the
2 second system comprises a switch coupling the DSSS transmitter, DSSS
3 receiver and the OFDM receiver to the antenna.

1 35. The communication network defined in Claim 25 wherein the
2 second system comprises a duplexer coupling the DSSS transmitter, DSSS
3 receiver and the OFDM receiver to the antenna.

1 36. The communication network defined in Claim 25 wherein the
2 OFDM transmitter is for downlink transmissions between the first system
3 and the second system and the DSSS transmitter of the second system is for
4 uplink transmissions from the second system to the first system, and further
5 wherein the first and second systems use frequency division duplexing
6 (FDD) to coordinate downlink and uplink transmissions.

1 37. The communication network defined in Claim 25 wherein the
2 OFDM transmitter is for downlink transmissions between the first system
3 and the second system and the DSSS transmitter of the second system is for
4 uplink transmissions from the second system to the first system, and further
5 wherein the first and second systems use time division duplexing (TDD) to
6 coordinate downlink and uplink transmissions.

1 38. The communication network defined in Claim 25 further
2 comprising a third system having a DSSS transmitter and an OFDM
3 receiver.

1 39. The communication method defined in Claim 25 further
2 comprising a fourth system having a DSSS transceiver.

1 40. The communication method defined in Claim 25 wherein the
2 first system further comprises an OFDM subcarrier allocator coupled to the
3 OFDM transmitter, the OFDM subcarrier allocator to adaptively allocate
4 subcarriers to the second system according to the signal-to-noise (SNR) ratio
5 information of each subcarrier associated with each of the second systems.

1 41. The communication network defined in Claim 40 wherein the
2 SNR information is measured by the first and second systems and fed back
3 to the OFDM subcarrier allocator.

1 42. The communication network defined in Claim 40 wherein the
2 SNR information is directly measured at the first system using an uplink
3 DSSS signal of each of the second system.

1 43. The communication network defined in Claim 40 wherein the
2 DSSS receiver of the first system further comprises a Rake receiver and a
3 channel estimator coupled to provide a channel estimate to the Rake
4 receiver, the channel estimator to send the channel estimate to the OFDM
5 subcarrier allocator for adaptive channel allocation.

1 44. The communication network defined in Claim 43 wherein the
2 channel estimator uses training sequences to generate the channel estimate.

1 45. The communication network defined in Claim 43 wherein
2 the channel estimator generates the channel estimate without training
3 sequences.

1 46. The system defined in Claim 25 wherein the second system
2 further comprises:

3 a beacon generator to generate a beacon signal; and
4 a switch coupled to the beacon generator to combine the beacon
5 signal with OFDM symbols to create a transmission signal for output
6 from the second system.

1 47. The system defined in Claim 46 wherein the beacon signal
2 comprises at least one spread-spectrum pseudo-noise (PN) sequence.

1 48. The system defined in Claim 46 wherein the beacon signal
2 comprises a plurality of spread-spectrum pseudo-noise (PN) sequences.

1 49. The system defined in Claim 48 wherein the subscriber
2 uses a first portion of the plurality of spread-spectrum pseudo-noise
3 (PN) sequences for time synchronization.

1 50. the system defined in Claim 49 wherein the first portion of
2 PN sequence comprises one PN sequence.

1 51. The system defined in Claim 49 wherein the subscriber uses a
2 second portion of PN sequences following the first portion of PN sequences
3 for frequency tracking.

1 52. The system defined in Claim 51 wherein PN sequences in
2 the second portion of PN sequences are shorter than any PN sequences
3 in the first portion of PN sequences.

1 53. The system defined in Claim 25 wherein the CDMA
2 transmitter is for uplink communications.

1 54. The system defined in Claim 53 wherein the OFDM transmitter
2 transmits full bandwidth pilot OFDM symbols during downlink for open
3 loop power control.